

REMARKS

Claims 1-24 are pending in the application and are rejected under 35 U.S.C. § 103(a) for being unpatentable over U.S. patent 5,394,473 (referred to as "Davidson") in view of U.S. patent publication no. 2005/0015259 (referred to as "Thumpudi").

Independent Claim 1

With regard to claim 1, the Office Action indicates that Davidson discloses all that is claimed except for applying an adaptable-length secondary transform to blocks of spectral components to generate hybrid-transform coefficients, where the length of the secondary transform is adapted in response to a block-length control signal; Thumpudi discloses applying a secondary transform (transformer 550) to blocks of spectral coefficients to generate hybrid coefficients; that an adaptation of the length of the secondary transform is an inherent feature because "as transformer 550 applies transform to coefficients of frequency transformer 530, the transformer 550 would be reliant on window size outputted in transformer 530"; and it would have been obvious to combine these teachings from Thumpudi with the teachings in Davidson, thereby reaching all that is claimed, to give more precise control to a coder when coding heavily correlated signals.

Applicants note that the present Office Action, unlike a prior office action, indicates that Davidson discloses the assembly of spectral coefficients representing the same frequency into one or more blocks of spectral coefficients whose length (or number of spectral coefficients) is adapted in response to a block-control signal. Applicants respectfully disagree for reasons discussed below.

Applicants also note the assertion in the Office Action that the length of the multi-channel transformer 550 in Thumpudi is reliant on the window size of the transformer 530. As explained below, this shows that Thumpudi does not disclose or suggest the claimed secondary transform.

Summary of Cited Prior Art

Davidson discloses audio encoders that apply transforms to blocks of audio samples to generate sets of transform coefficients. The sets of transform coefficients are encoded and assembled into a bitstream for transmission or storage (col. 15 lns. 36-60). The transform coefficients in each set collectively represent a set of frequencies for a particular time segment across the bandwidth of the input audio signal. The length of the transforms, the number of audio samples in each block of samples, and the number of coefficients in each set of transform coefficients is adapted in response to signal events such as transients. The frequency represented by a particular transform coefficient in each set is affected by the length of the blocks of audio samples

that are input to the transform because the length of the sample blocks affect the frequency resolution of the transform (col. 4 lns. 23-34).

Blocks of audio samples are assembled into frames using any one of three different techniques. Two of the techniques referred to as Fixed Frame Alignment and Enhanced Frame Alignment produce fixed-length frames. The third technique, which the Office Action indicates teaches certain claim features, is referred to as Dynamic Frame Alignment (DFA).

The DFA technique is able to produce variable length frames (col. 31 lns. 60-65). As a result, the number of transform coefficients generated using DFA can change continuously, which can cause problems with encoded signal formatting in systems that require fixed-length frames or constant bit rates. Davidson discloses the use of a circular buffer as one way to solve this problem; when a specified number of bits representing encoded transform coefficients are stored in the buffer, its contents are formatted, appended to frame synchronization bits and then transmitted or stored (col. 32 ln. 64 to col. 33 ln. 2). The bits are assembled and formatted without regard to frame boundaries or even individual transform coefficients. In other words, the identity of individual transform coefficients and sets of transform coefficients is ignored during this formatting process.

Thumpudi discloses a coding system that uses transformer 530 to convert audio samples into the frequency domain [see paragraph 0127]. The transformer 550 that the Office Action indicates is the claimed secondary transform is referred to in Thumpudi as a multi-channel transform, which is applied to frequency coefficient data from "tiles" of audio data from different channels [0131]. A "tile" is a group of audio blocks "co-located in time" that have the same length [0126]. As its name implies, the multi-channel transformer is applied to multi-channel data; Thumpudi does not teach using this transform in any other manner. The Office Action indicates the length of the transformer 550 is adapted in response to a block-length control signal because its length is inherently reliant on the window size of the transformer 530. This distinguishes Thumpudi from the claimed invention as explained below.

Comparing the Cited Art to the Claimed Invention

As amended, the third step of claim 1 reads as follows:

generating one or more sets of hybrid-transform coefficients by applying a secondary transform to one or more blocks of the spectral coefficients representing spectral content of the source signal for a particular frequency in the set of frequencies across time, wherein the number of spectral coefficients in each of the one or blocks representing the particular frequency is adapted in response to a block-length control signal and the length of the secondary transform that is applied to each of the one or more blocks of spectral coefficients is adapted in response to the block-length control signal.

Applicants respectfully submit that this differs from what can be obtained from a combination of teachings in Davidson and Thumpudi.

The Office Action refers to a circular buffer technique in Davidson to show an assembly of blocks of spectral coefficients representing the same frequency. This technique does not assemble individual coefficients but instead assembles bits without regard to what they represent. When a certain number of bits is buffered, those bits are formatted for output. There is no teaching to assemble individual coefficients that represent the same frequency. There also is no teaching to adapt the number of these coefficients (representing the same frequency) in each block in response to some control signal. The purpose of the disclosed technique is to assemble a fixed number of bits, not a varying number of bits, and this is done without regard to what they represent and without regard to the length of the transform.

The Office Action indicates the multi-channel transformer corresponds to the claimed secondary transform that is applied to blocks of spectral coefficients representing the same frequency. Claim 1 is amended to recite expressly what was implied before; the spectral coefficients in each block represent a particular frequency across time. Thumpudi does not teach such a transform. Instead, Thumpudi teaches applying a transform to bands of coefficients [0131] from "tiles" of audio data for multiple channels that are co-located in time [0126]. In other words, Thumpudi discloses a transform that is applied to transform coefficients for a particular time across frequency.

This difference is shown by statements in the Office Action that indicate the length of the transformer 550 is reliant on the window size of the transformer 530. This window size is the number of audio samples in a segment of samples that are transformed by the transformer 530 into a block of coefficients, which in turn is related to the number of transform coefficients that are in the block. This block of transform coefficients collectively represent the spectral content of the segment across the bandwidth of the signal. If the length of the transformer 550 is inherently equal to the window size as asserted in the Office Action, this is because it is applied to individual blocks of transform coefficients. In other words, the Office Action implicitly indicates the transformer 550 is applied to blocks of transform coefficients for a particular time segment across frequency, which is contrary to what is claimed – a block of coefficients representing a particular frequency across time.

Independent Claim 6

Claim 6 recites a method that is complementary to the method recited in claim 1. Claim 1 is directed toward encoding a signal. Claim 6 is directed toward decoding an encoded signal.

With regard to claim 6, the Office Action indicates that Davidson discloses all that is claimed except for applying an adaptive-length inverse secondary transform to one or more sets of hybrid transform coefficients to generate blocks of spectral coefficients representing spectral content for the same frequency; that Thumpudi discloses this missing feature; and that it would have been obvious to combine these teachings from Thumpudi with the teachings in Davidson "to give more precise control to a coder when coding heavily correlated signals."

Applicants amend claim 6 to recite expressly what was originally expressed implicitly and respectfully submit that neither Davidson nor Thumpudi disclose or suggest applying an inverse second transform to blocks of hybrid-transform coefficients as claimed. This is discussed in the following paragraphs.

Summary of Cited Art

Both Davidson and Thumpudi disclose audio decoders that recover audio information from signals that have been encoded by the disclosed encoders. Thumpudi indicates that the inverse multi-channel transformer either does nothing ("passes the channels through") if the channel data are coded independently or it converts data into independently coded channels if the channel data are jointly encoded [0040], [0144].

Comparing the Cited Art to the Claimed Invention

As amended, the third step of claim 6 reads as follows:

applying an inverse secondary transform to the one or more sets of hybrid-transform coefficients to generate one or more blocks of spectral coefficients representing spectral content of the source signal for a particular frequency in a set of frequencies across time, wherein the number of hybrid-transform coefficients in each of the one or more sets of hybrid-transform coefficients is adapted in response to the block-length control signal and the length of the inverse secondary transform that is applied to the sets of hybrid-transform coefficients is adapted in response to the block-length control signal.

Applicants respectfully submit that this differs from what can be obtained from a combination of teachings in Davidson and Thumpudi.

The decoders in Davidson and Thumpudi do not disclose or suggest the features of claim 6 for the same reasons discussed above for claim 1. Neither reference teaches the claimed inverse secondary transform that generates blocks of spectral coefficients representing the same frequency across time, or the use of these blocks to prepare an input to the inverse primary transform.

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Other Claims

The preceding discussion for claims 1 and 6 apply to claims 10, 15, 19 and 22. The remaining claims depend on one of the independent claims and add further limitations thereto. Applicants amend claim the dependencies.

With regard to claims 3 and 12, the Office Action refers to a transient detector in Davidson and alleges this discloses what is claimed. Applicants disagree. The transient detector in Davidson analyzes temporal characteristics of the input signal and controls the length of a transform that corresponds to the primary transform in claim 1. In contrast to this, the features of claim 3 analyze characteristics of the output of the primary transform and generates a signal that controls the length of the secondary transform. Applicants note that these reasons were explained in a previous communication but the Office Action does not address them.

CONCLUSION

Applicants amend the claims as shown above and request reconsideration of the claims in view of the preceding discussion.

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I certify that this Response to Office Action and any following materials are being transmitted by facsimile on August 4, 2008 to the U.S. Patent and Trademark Office at telephone number (571) 273-8300.



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